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SCREENING TESTS AGAINST HOUSE FLIES WITH SOME DERIVATIVES OF CHRYSANTHEMUMIC ACID

By Norman Mitlin, Nathan Green, W. A. Gersdorff, and M. S. Schechter
Division of Insecticide Investigations

Many materials related to allethrin that were prepared in this laboratory have shown no, or relatively little, toxicity when tested against house flies (Musca domestica L.). Some of them were evaluated at the same time as materials found to be more toxic and therefore were included in reports of these studies (Gersdorff 1, Gersdorff and Mitlin 2, and LaForge et al. 3). Many, however, were tested in groups in which none of the materials showed promise for house fly control, and their evaluations were not reported. To make this information available it is assembled in this report.

Materials

These materials, although derivatives of chrysanthemumic acid, as is allethrin (dl-allethrolone esterified with a mixture of cis and trans dl-chrysanthemumic acids), were less closely related than those previously reported. In their preparation the allethrolone portion of the molecule was replaced by widely differing compounds. These were of three types, alcohols, phenols, and amines.

The esters of the alcohols and phenols were prepared by reacting them with a mixture of cis and trans dl-chrysanthemumoyl chlorides in a hydrocarbon solvent in the presence of pyridine.

About 0.1 mole of the anhydrous alcohol or phenol was placed in a 500-ml. flask with 250 ml. of low-boiling petroleum ether and 0.12 mole of pyridine. If the alcohol or phenol did not dissolve, a small amount of dry benzene was added, although it was not considered necessary to have all the material in solution. The flask was placed under a reflux condenser and the acid chloride (0.105 mole) was added cautiously through the condenser while the flask was agitated. When the reaction subsided, the flask was stoppered and allowed to stand overnight. The next day water was added and the layers were separated. The upper layer was washed successively with 5-percent sodium hydroxide solution, water,

10-percent hydrochloric acid solution, water, and finally with saturated sodium chloride solution. The addition of a little ethyl ether was required in a few instances to dissolve the product. After filtration through cotton, the solvents were removed on a steam bath and finally in a vacuum. The products were not purified.

The amides were prepared in exactly the same fashion, an amine being used in place of the alcohol or phenol.

In the case of dihydroxy compounds, 0.21 mole of the mixed cis and trans dl-chrysanthemumoyl chlorides was employed per 0.10 mole of alcohol or phenol in order to favor production of the diesters. The derivative of p-aminophenol, which is an ester as well as an amide, was prepared by employing a ratio of 0.21 mole of the mixed acid chlorides per 0.10 mole of p-aminophenol.

The products were dissolved in refined kerosene or in mixtures of acetone and kerosene at different concentrations.

The standard of comparison used was pyrethrins, in refined kerosene, at 1 mg. per milliliter. This spray caused 100-percent knockdown in all tests.

Procedure

Knockdown and mortality were determined in duplicate tests made on laboratory-reared house flies using the Campbell turntable method. Approximately 100 flies of 2 to 3 1/2 days of age were used in each test.

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Results

The mortality and knockdown data are assembled in table 1.

Since the materials were tested on many different populations of flies and hence with many different pyrethrum standards, comparison was made with pyrethrins at 1 mg. per milliliter, giving a range of 10 to 25 percent mortality in one group and 26 to 35 percent in another.

The compounds showed little toxicity at the concentrations tested. All were less than 0.06 as effective as pyrethrins, most of them less than 0.03.

Literature Cited

(1) Gersdorff, W. A.
1949. Toxicity to house flies of synthetic compounds of the pyrethrin type in relation to chemical structure. Jour. Econ. Ent. 42(4): 532-536.

(2) _____ and Mitlin, Norman
1951. Relative toxicity of allethrin analogs to house flies. Jour. Econ. Ent. 44(1): 70-73.

(3) LaForge, F. B., Gersdorff, W. A., Green, Nathan, and Schechter, M. S.
1952. Allethrin-type esters of cyclopropanecarboxylic acids and their [illegible]. Jour. Org. Chem. 17(3): 381-389.

http://archive.org/details/chryestsag00unit

Table 1.--Knockdown and mortality of house flies caused by derivatives of cis and trans dl-chrysanthemumic acids. All tests in duplicate unless otherwise noted. Concentration 32 mg. per milliliter.

Materials	Knockdown in 25 minutes	Mortality in 24 hours
	Percent	Percent
16 to 25 Percent Mortality With Pyrethrum Standard		
Esters of alcohols:		
Butanol, 2-ethyl-	4	10
Cholesterol	2	3
Cetyl alcohol	0	1
Cyclohexanol, 2-sec-butyl-	2	5
Cyclohexanol, 2-cyclohexyl-	2	3
Cyclohexanol, 4-cyclohexyl-	5	4
Decyl alcohol	0	7
Ethanol, 2-(p-tert-butylphenyl)-	1	3
Ethanol, 2-cyclohexyl-	1	6
Ethanol, 1-(p-tolyl)-[1]	15	2
Fenchyl alcohol	0	7
Furfuryl alcohol	86	6
3-Heptanol	0	8
4-Heptanol[3]	9	2
4-Heptanol,2,6-dimethyl-	0	7
1,3-Hexanediol,2-ethyl-	0	6
2,4-Hexadien-1-ol-	1	4
Lauryl alcohol	0	9
2,6-Octadien-4,5-diol (diester)	0	2
Octyl alcohol	0	5
Phenethyl alcohol,α,α-dimethyl[1]	86	1
Esters of phenols:		
Acetophenone, p-hydroxy-	1	4
Benzophenone, p-hydroxy-	1	3
Catechol (diester)	0	4
o-Cresol,4-chloro-	3	10
o-Cresol,6-chloro-	1	4
p-Cresol[2]	26	5
Hydroquinone (diester)[1,2,3]	25	7
Phenol,p-methoxy-[2]	25	7
8-Quinolinol[1]	15	2
Resorcinol (diester)[2]	1	3

Table 1.--Continued

Materials	Knockdown in 25 minutes	Mortality in 24 hours
	Percent	Percent
16 to 25 Percent Mortality With Pyrethrum Standard--continued		
Amides:		
Amylamine	0	3
Amylamine,1-methyl-	0	4
Butylamine	0	4
Butylamine,1-methyl-	1	8
Carbazole[1]	39	3
Diamylamine	1	2
Dioctylamine	0	3
Diphenylamine[1]	2	4
Heptylamine	0	6
Isobutylamine	2	5
Octylamine	0	3
Phenol,p-amino-[2]	1	3
Pyrrolidine	58	10
26 to 35 Percent Mortality With Pyrethrum Standard		
Esters of alcohols:		
Benzyl alcohol,α-methyl-	1	16
Benzyl alcohol,α-(trichloromethyl)-	1	13
1,3-Butanediol (diester)	3	1
2,3-Butanediol (diester)	3	9
2-Butanol,1,1,1-trichloro-2-methyl-	0	6
Ethanol,2-butoxy-	3	1
Ethanol,2-(2-butoxyethoxy)-[3]	2	4
Ethanol,2-chloro-	2	4
Ethanol,2-diethylamino-	9	2
Ethanol,2-dimethylamino-[1]	4	9
Ethanol,2-ethoxy-[3]	1	7
Ethanol,2-(2-ethoxyethoxy)-[3]	2	4
Ethanol,2-methoxy-	6	3
Ethanol,2-(2-methoxyethoxy)-[3]	1	5
Ethanol, 2-phenoxy-	0	3
Furfuryl alcohol, tetrahydro-	1	3
3-Hexyne-2,5-diol,2,5-dimethyl	1	4

Table 1.--Continued

Materials	Knockdown in 25 minutes	Mortality in 24 hours
26 to 35 Percent Mortality With Pyrethrum Standard--continued		
Esters of alcohols (cont'd.):		
4-Morpholineethanol[1/]	4	9
2-Nitropropanol,2-methyl-	1	8
Phenethyl alcohol, p-isopropyl-	1	6
2-Propanol,1-chloro-	3	17
Propargyl alcohol	2	2
2-Propen-1-ol,2-methyl-	3	9
α-Terpeneol	5	5
Esters of phenols:		
2-Acetonaphthone,1-hydroxy-[1/]	89	2
o-Cresol	1	3
m-Cresol	6	8
m-Cresol, amyl-	11	5
p-Cresol-2-nitro-	2	13
Eugenol	2	2
cis-Isoeugenol	1	4
trans-Isoeugenol	1	6
Isoeugenol, benzyl-	3	7
1-Naphthol	1	7
2-Naphthol	1	4
Phenol,p-tert-butyl-	0	3
Phenol,o-chloro-	3	6
Phenol,p-chloro-	1	5
Phenol,m-methoxy-	42	7
Thiophenol	1	13
Vanillyl alcohol (diester)	0	8
Amides:		
Allylamine	42	4
Morpholine[1/]	51	9
Piperidine[1/]	48	7

1/ Acetone used as an auxiliary solvent.

2/ Replicated three times.

3/ 16 mg. per milliliter.

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